National Institute of Environmental Health Sciences

Effects of ozone depletion and UV-B radiation on humans and the environment

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Abstract:

There are important effects of changes in the intensity of solar UV-radiation resulting from stratospheric ozone depletion, particularly UV-B radiation, on all organisms on the planet. Biological and ecological responses to increases in UV-B radiation may be deleterious and result in harm to humans, particularly in terms of the incidence of cataracts of the eye and cancers of the skin, such as malignant melanoma. UV-B radiation is important in the production of vitamin D which has beneficial effects on human health, not only in terms of calcium balance and bone development but it also appears to have a protective effect in several other human diseases. In individual organisms in the environment, and ecosystem processes, UV-B radiation may have adverse effects or these may be compensated for in individual species or groups of species, resulting in little overall harm. These compensation mechanisms may have implications for other herbivores and predators that depend on the affected organism for food or habitat. When coupled with changes in the distribution and biology of organisms that will result from climate change, the resulting interactions may cause significant ecological changes that have implications for the sustainability of natural populations as well as human activities that depend on ecosystem services that are provided by the affected organisms. This has implications for human activities such as fisheries, agriculture, and forestry that are economically important in Canada and many other countries. In addition to these direct effects on humans and the ecosystem, increases in UV-B radiation may have effects on nutrient and material cycling in terrestrial systems and in fresh and salt surface waters. Many of these processes involve dissolved organic matter (DOM) and coloured DOM (CDOM) and their production in terrestrial systems and inputs to surface waters where they have protective effects on plants and animals. Atmospheric chemistry has also been affected by increased UV-B radiation; some of the effects will result in increased biological availability of toxic metals such as mercury. However, the resultant product of the breakdown of the 'ozone- friendly' hydrochloro-fluorocarbons (HCFCs) and hydrofluorocarbons (HFCs) - trifluoroacetic acid - presents a negligible risk to humans and the environment. Increased UV-B radiation has implications for a number of human-made materials such as plastics used in construction and outdoor materials. The effects of UV-B radiation can be counteracted by protective fillers but there may be interactions with increased environmental temperatures that affect the efficiency of these protectants. Overall, the effects of UV-B radiation on organisms, the environment, and materials are expected to decrease as stratospheric ozone recovers; however, the potential effect of climate change on these endpoints is uncertain and it is possible that increases in temperature may combine in additive, synergistic, or antagonistic ways with the effects of UV-B radiation that are currently unpredictable.

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Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Air Pollution, Ecosystem Changes, Solar Radiation, Temperature

Air Pollution: Ozone

Temperature: Fluctuations

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location:

resource focuses on specific location

Global or Unspecified

Health Impact:

specification of health effect or disease related to climate change exposure

Cancer, Other Health Impact

Other Health Impact: eye diseases

Resource Type:

format or standard characteristic of resource

Review

Timescale:

time period studied

Time Scale Unspecified